R4

8940014.1 89-4-059

S1

On-Refuge centered

Final Report
Cartagena Lagoon Contaminants Survey

Prepared by Felix Lopez
EC Specialist, Caribbean Field Office
Boqueron, Puerto Rico

January 4, 1989

BACKGROUND

Cartagena Lagoon is located in the Lajas Valley, south western Puerto Rico (Figure 1). It is the sole existing fresh water system in the area. The other two fresh water systems, Anegado and Guanica Lagoon were drained for agricultural purposes in the early 1950's. Cartagena covers an area of some 320 acres with an average depth of 3 feet and an estimated water storage of 750 acre-feet. The lagoon receives agricultural runoff from surrounding sugarcane fields, sewage effluent from the Lajas Waste Water Treatment Plant and nearby Maguayo community. The Lajas WWTP discharges into Plantina Creek which then discharges into the Lajas Valley irrigation system, which eventually discharges agricultural runoff and sewage into Cartagena lagoon. A drainage channel has been cut on the western shore of the lagoon and the lagoon constantly drains through the west main drain of the Lajas Irrigation System. A pumphouse is located to the northwest, and water is pumped for irrigation in times of drought.

Because of the high nutrient load, the lagoon has been eutrophying at an accelerated rate. Typha and water hyacinths currently cover 85-90% of the lagoon's surface. In the past 20 years the open water area of the lagoon has been reduced an estimated 90-95% Although it is currently degraded and eutrophic the lagoon is still considered one of Puerto Rico's significant waterfowl habitats and is used by local hunters.

Historical information indicates that the Lajas Valley has been an important agricultural center for over 100 years. Intensive irrigation started in the 1950's. Intensive application of pesticides started with the use of DDT for mosquito control. Hundreds of pounds of calcium oxide (CaO) were also applied to the lagoon in the late 1940's as part of mosquito control measures. The intensive irrigation system created in the 1950's uses the lagoon as one of the receiving bodies for agricultural runoff.

The lagoon has been slated for acquisition since 1978 (Appendix 1). Recently the Commonwealth of Puerto Rico through the P.R. Land Administration has started the process to acquire the lagoon and surrounding lands. About 800 acres will be acquired. The Fish and Wildlife Service is negotiating with the Commonwealth to lease the land and manage it as a Wildlife Refuge. An MOU is currently being worked out by FWS Realty and the Commonwealth for a 100 year lease.

In accordance with current Service policy, a contaminants survey was carried out prior to any Service commitment. A literature search revealed very little information on the possible contaminant issues that might be associated with the lagoon. Most literature discussed the importance of the lagoon to wildlife. USGS provided only sporadic flow data, and Commonwealth Agencies have all dealt with the lagoon from a wildlife value stand point.

SAMPLING

Sampling was carried out over a two month period and consisted of sediment and biological sampling. Composite sediment samples were taken from various points around the lagoon (Figure 2). Vegetation made boat access impossible. As a result no sediment samples were taken from the lagoon's interior. The southern shore of the lagoon slopes rapidly and samples were taken close to shore. The northern shore has a more gradual slope and EC biologists were able to wade further in to sample. Sediments consist of an organic layer several inches to a foot deep, underlain by Guanica or Aguirre clay. Sediment samples were collected using PVC cores, composited and frozen in glass jars prior to shipping.

Biological sampling proved to be more difficult than anticipated. Sampling efforts were concentrated along the north shore where aquatic vegetation was not as dense and allowed personnel to move somewhat easier. It was planned to collect bird livers, turtle livers and leaches. Leaches were discarded due to lack adequate data regarding their use as bio-indicators. Turtle traps were vandalized/stolen by local residents. Only one turtle was caught, but it had drowned and was partially decomposed when recovered. The remaining traps were lost when heavy rains flooded the area and washed them away.

Heavy rains, flooding and the secretive habits of the resident water fowl hampered biological sampling. It was hoped that resident coots, and moor hens would be collected, however, they tended to remain hidden in the dense vegetation and proved impossible to collect. Common egrets and green backed herons were used, since they were easier to collect.

RESULTS

Organochlorine analysis did not reveal any OCH traces in the sediments. Low traces of some OCHs including DDE were found in both bird liver samples (Appendix 2). DDE shows the persistence of this substance in the environment and can be traced back to the extensive use of DDT for mosquito control. Other OCHs found are the result of exposure to agricultural chemicals. The fact that no OCHs were found in the sediment should not be mis-interpreted; sediment samples were limited to the periphery of the lagoon. Contaminated sediments could have settled in the deeper, inaccessible center of the lagoon.

Heavy metal analysis shows some bioaccumulation of mercury in waterfowl but concentrations are well below those known to cause any lethal or sublethal effects.

RECOMMENDATIONS

This preliminary study has not revealed any serious contaminant problem for the Cartagena Lagoon area. Agricultural runoff and sewage effluent will have to be controlled if there is any hope of recovery for the lagoon. Aquatic plant control methods will have to be applied for the creation of open water. Basic water quality data should be taken at regular intervals to create a data base from which to monitor the lagoon. Management of this area as a Wildlife Refuge will increase its value to the fish and wildlife resources of the area, and restore a vital link in the Atlantic Flyway migratory route.


SAN JUAN
MAYAGUEZ
PONCE
CAGUAS

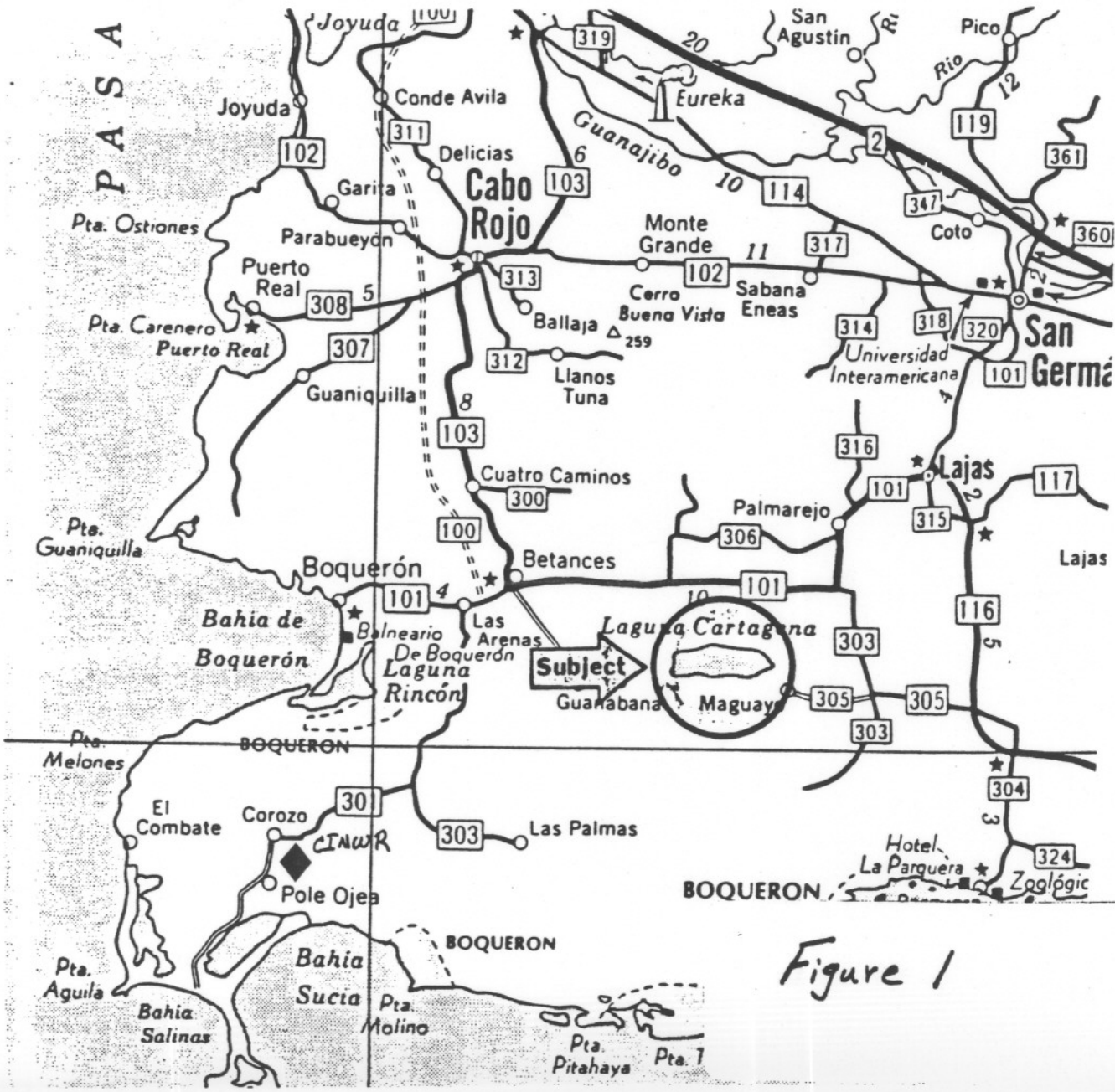

PASA
Joyuda
Conde Avila
Joyuda
Delicias
Garita
Cabo Rojo
Pta. Ostiones
Parabueyón
Puerto Real
Pta. Carenero
Puerto Real
Guaniquilla
Pta. Guaniquilla
Boquerón
Bahia de Boquerón
Balneario De Boquerón
Laguna Rincón
Betances
Las Arenas
Cuatro Caminos
Ballaja
Llanos Tuna
Monte Grande
Cerro Buena Vista
Sabana Eneas
Eureka
Guanajibo
San Agustin
Pico
Rio
Coto
Universidad Interamericana
San Germá
Lajas
Palmarejo
Laguna Cartagena
Subject
Guanabana
Maguayo
Pta. Melones
BOQUERON
El Combate
Corozo
CINWR
Pole Ojea
Las Palmas
Hotel La Parguera
Zoológic
Bahia Salinas
Bahia Sucia
Pta. Molino
Pta. Pitahaya
Pta. 1

Figure 1

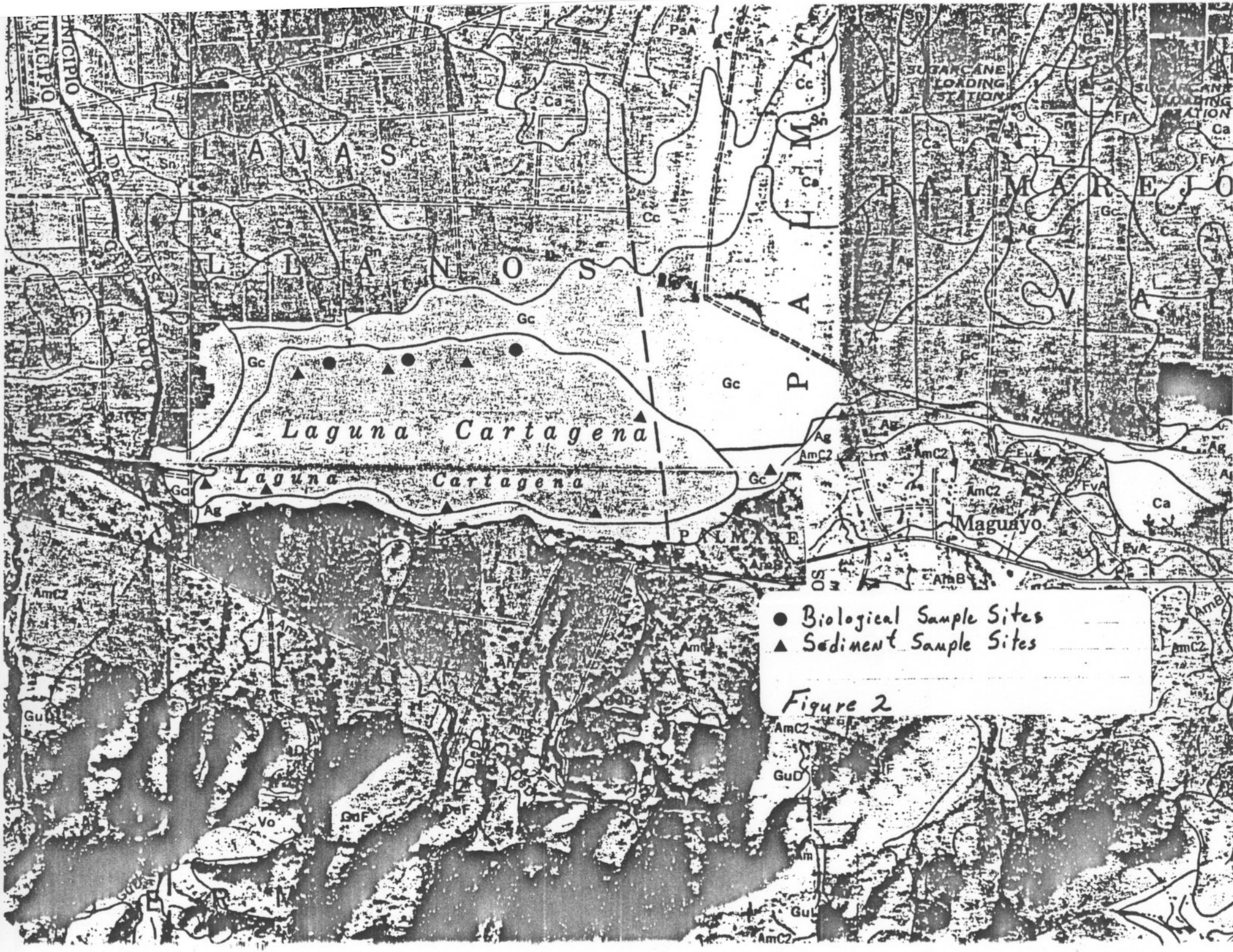

LAJAS
LLANOS
PALMAREJO
Laguna Cartagena
Laguna Cartagena
Maguayo
● Biological Sample Sites
▲ Sediment Sample Sites

Figure 2

IX. UNIQUE OR NATIONALLY SIGNIFICANT WILDLIFE ECOSYSTEM

PROJECT DESCRIPTION NO. 1

NAME OF AREA Cartagena Lagoon TOTAL ACRES 800

LOCATION (Attach letter-size map) Puerto Rico Lajas
Municipality

LEGAL DESCRIPTION

Meridian	Township	Range	Sections	18°01' Latitude	67°06' Longitude

I. ECOLOGICAL UNIQUENESS/SIGNIFICANCE -

Cartagena Lagoon is the finest fresh water swamp remaining in Puerto Rico. Over half of Puerto Rico's avian species have been recorded from the lagoon and the nearby hills. Two species on the Federal Endangered species list and 29 species on the Commonwealth list occur at the Lagoon or adjacent hills.

II. WILDLIFE VALUES -

A. Endangered and Threatened Species (Federally listed) -

Species Name		Degree of Use
Peregrine falcon	- E	rare migrant; probably roosts and forages
Yellow-shouldered blackbird	- E	winter resident; roosts and forages

Inland areas such as Cartagena Lagoon are important for roosting and foraging during the winter when the LaParguera/Boquerón Forest nesting area populations (the largest remaining) migrate inland for several months.

B. Endangered and Threatened Species (Commonwealth-listed)

Species Name		Degree of Use
American bittern	- VE	winter resident
Black-bellied whistling duck	- VE	resident, former breeding resident
Mallard	- VE	winter resident
Masked duck	- VE	resident, possible nester
West Indian whistling duck	- VE	resident, probable nester
White-cheeked pintail	- VE	resident
Black-crowned night heron	- E	resident, possible nester
Fulvous whistling duck	- E	resident, possible nester
Glossy ibis	- E	resident, possible nester

Appendix 1

Hudsonian godwit	- E	winter resident
Least grebe	- E	resident
Marbled godwit	- E	winter resident
Pintail	- E	winter resident
Puerto Rican short-eared owl	- E	resident
Ring-necked duck	- E	winter resident
Shoveler	- E	winter resident
Sora rail	- E	winter resident
Yellow-breasted crake	- E	resident, probable nester
Caribbean coot	-OTV	breeding resident
Golden plover	-OTV	winter resident
Great blue heron	-OTV	resident
Great egret	-OTV	resident
Green-winged teal	-OTV	winter resident
Osprey	-OTV	winter resident
Purple gallinule	-OTV	breeding resident
Ruddy duck	-OTV	breeding resident
Snowy egret	-OTV	resident

C. Species of Special Concern -

D. Faunal Diversity -

Most of Puerto Rico's bird species have been recorded on the area described. Many of these species are already quite reduced in abundance. Loss of Cartagena Lagoon could mean the loss of some species from Puerto Rico's avifauna (e.g., yellow-breasted crake, black rail, sora rail). Because this habitat type is itself "endangered" in Puerto Rico, its preservation would undoubtedly help to maintain the faunal diversity of Puerto Rico.

III. HABITAT COMPOSITION (Types and Acres) -

Freshwater lagoon
Marshy grassland
Grassland and cultivated sugar cane
Grass and scrub lowlands and hillsides

IV. OWNERSHIP AND ESTIMATED ACQUISITION COSTS -

The area is privately owned. There appear to be six blocks of land holdings with at least 10 owners. The prices in that area range between $3000-$5000 per acre. Total cost: $2.4-$4.0 million.

V. THREAT OF DESTRUCTION/ALTERATION -

A. Nature of Threat -

The lagoon is surrounded by sugar cane fields and cattle graze in and around it at present. Ectrophication has begun because of increased fertilizer use. Partial drainage of the lagoon has been occuring for about 50 years. The total conversion of the lagoon into agricultural lands--rice paddies, for instance--could occur.

B. Imminence of Threat -

In many respects this area has been degraded already. Total destruction is imminent.

VI. DEVELOPMENT AND/OR MANAGEMENT NEEDS -

In Critical Wildlife Areas of Puerto Rico, Raffaele states the following: "The lagoon needs a substantial amount of habitat management to control aquatic weeds which are proliferating probably as a result of the increased use of fertilizers in the Lajas Valley over the last two decades. Controls would probably best include (1) the raising of the spillway at the west end of the lagoon and installing a lock there to control water outflow, (2) the dividing of the rest of the lagoon into three or more segments by the construction of dikes with water flow between them controlled by locks. and movable pump and (3) fortification of the dikes around Cartagena's perimeter.

The division of Cartagena Lagoon into compartments would give managers better control of the limited water flow to the lagoon enabling them to drain portions of it for plant control and at the same time permit them to maintain suitable habitat for native aquatic birds and waterfowl. An additional benefit of diking would be that access to many portions of Cartagena would be increased by making it a spectacular area for one-day visits by school groups and for family recreation."

VII. REACTION OF OTHERS TO PRESERVING AREA -

Virtually every biologist who is working or has worked in Puerto Rico has stressed the need for acquisition of Cartagena Lagoon. This includes James Wiley, Riccardo Cotte, Ralph Swanson (all with FWS), David Belitsky, (P.R. Department of Natural Resources), Herbert Raffaele, Dr. Ariel Lugo, (both formerly with P.R. Department of Natural Resources) and Dr. Frank Wadsworth (U.S. Forest Service).

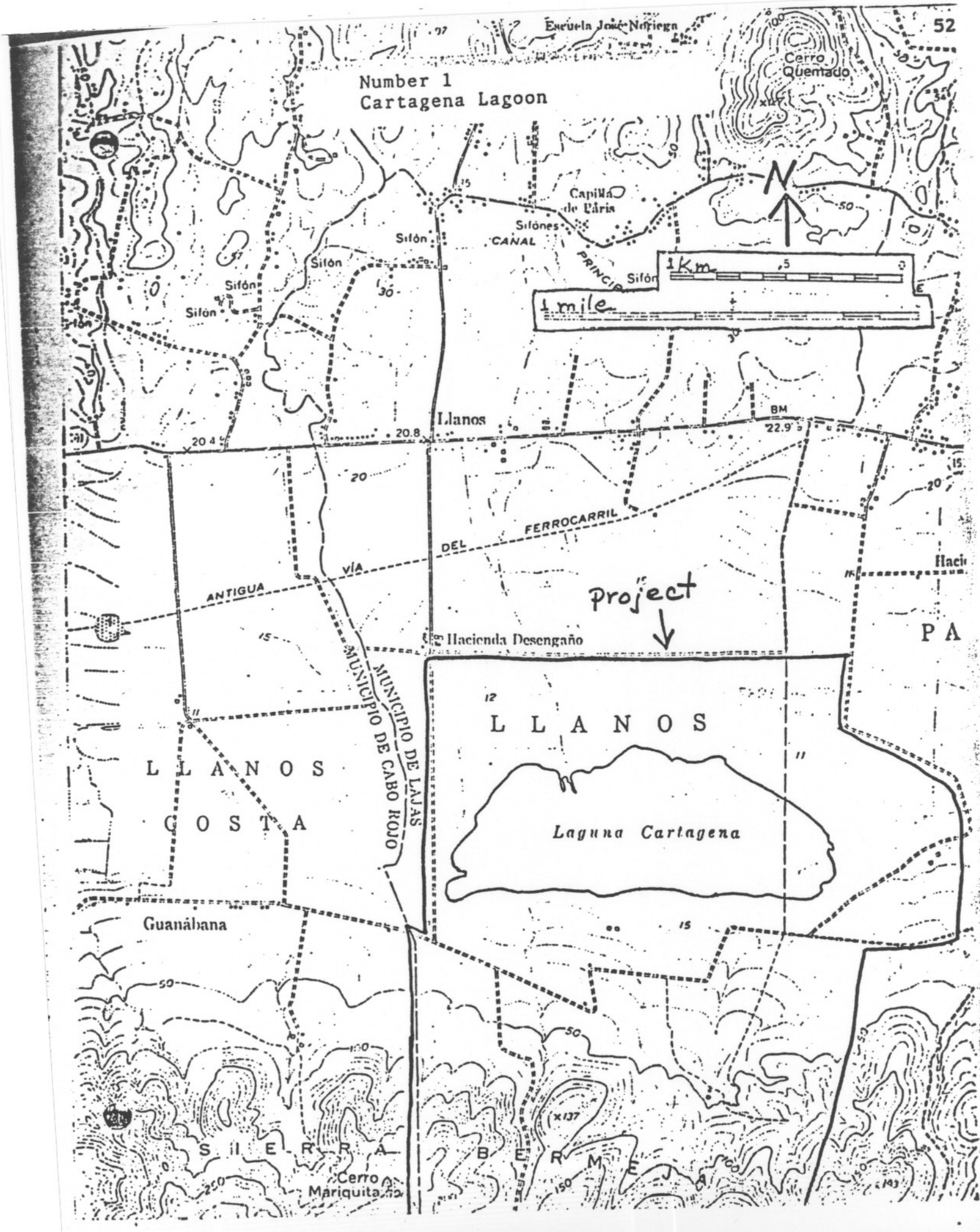
VIII. OTHER COMMENTS -

Cartagena Lagoon is less than 20 miles from the newly-established Cabo Rojo National Wildlife Refuge.

IX PREPARED BY -

Name and Title Gail S. Baker, Biologist
Agency/Organization Florida Habitat Ascertainment Office
Address USFWS 900 San Marco Blvd. Jacksonville, FL 32207

Date Completed December 28, 1978


Number 1
Cartagena Lagoon
Escuela José Nofiega
Cerro Quemado
Capilla de París
Silónes
CANAL
PRINCIPE
Silón
1 Km
1 mile
Llanos
BM
22.9
20.8
FERROCARRIL
DEL
VIA
ANTIGUA
Project
Hacienda Desengaño
MUNICIPIO DE LAJAS
MUNICIPIO DE CABO ROJO
L L A N O S
C O S T A
L L A N O S
Laguna Cartagena
Guanábana
S I E R R A
B E R M E J A
Cerro Mariquita

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI
STATE CHEMICAL LABORATORY
BOX CR - MISSISSIPPI STATE, MISSISSIPPI 39762

October 21, 1988

Mr. Danny Day
Stickel Building/Chemistry
Patuxent Wildlife Research Center
U.S. Fish and Wildlife Service
Route 197
Laurel, MD 20708

Dear Danny:

Enclosed are analytical results for one batch of samples submitted by the U.S. Fish and Wildlife Service (Catalog #5715, Batch #027-88-R4, Order No. 85800-88-30176). The samples were analyzed by Methods 1 & 2; descriptions are enclosed.

Please call if you have any questions.

Sincerely,

Larry Lane

Larry G. Lane
Principal Investigator

Appendix 2

SAMPLE TYPE: Sediment and Bird Liver

CAT NO. 5715
BATCH NO. 027-88-R4
ORDER NO. 85800-88-30176

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

ORGANOCHLORINES

DATE RECEIVED 09/29/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CL-SED-2	CL-SED-4	CL-SED-6	CL-LV-2	CL-LV-4	Blank	Matrix Blank
LAB #	756878	756879	756880	756881	756882	756883	for
MATRIX	Sediment	Sediment	Sediment	Bird Liver	Bird Liver	Reagent	Liver
COMPOUND							
HCB	ND*	ND	ND	ND	ND	ND	ND
α-BHC	ND	ND	ND	ND	ND	ND	ND
r-BHC	ND	ND	ND	ND	ND	ND	ND
β-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	ND	ND	ND	0.03	ND	ND	ND
Hept. Epox.	ND	ND	ND	0.02	ND	ND	ND
r-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	ND	ND	ND	0.02	ND	ND	ND
Toxaphene	ND	ND	ND	ND	ND	ND	ND
PCB's (total)	ND	ND	ND	1.0#	ND	ND	ND
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	ND	ND	ND	ND	ND
p, p'-DDE	ND	ND	ND	0.67#	0.10	ND	ND
Dieldrin	ND	ND	ND	0.05	ND	ND	ND
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	ND	ND	ND	ND	ND	ND	ND
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	ND	ND	ND	ND	ND	ND	ND
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	ND	ND	ND	ND	ND	ND	ND
OTHER:							
WEIGHT (g)	107	298	297	21.5	24.1	-	-
MOISTURE (%)	34.4	34.6	31.6	64.0	63.0	-	75.2
LIPID (%)	-	-	-	18.4	17.6	-	3.88

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ____ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

SAMPLE TYPE: Sediment and Bird Liver

CAT NO. 5715
BATCH NO. 027-88-R4
ORDER NO. 85800-88-30176

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

ORGANOCHLORINES

DATE RECEIVED 09/29/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	Spike**	% Recovery					
LAB #	756886						
MATRIX	Liver						
COMPOUND							
HCB	0.065	65					
α-BHC	NS***						
r-BHC	0.095	95					
β-BHC	0.091	91					
ɣ-BHC	NS						
Oxychlordane	0.078	78					
Hept. Epox.	0.096	96					
r-Chlordane	NS						
t-Nonachlor	0.090	90					
Toxaphene	NS						
PCB's (total)	NS						
o, p'-DDE	0.099	99					
α-Chlordane	0.081	81					
p, p'-DDE	0.10	100					
Dieldrin	0.098	98					
o, p'-DDD	NS						
Endrin	0.099	99					
cis-nonachlor	0.086	86					
o, p'-DDT	0.097	97					
p, p'-DDD	0.10	100					
p, p'-DDT	0.10	100					
Mirex	0.094	94					
OTHER:							
WEIGHT (g)	-	-					
MOISTURE (%)	76.3	-					
LIPID (%)	4.02	-					

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = 0.10 ppm for Liver
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature